

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
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AIM 5202

STUDENT OUTLINE

REBUILD MK48 AIR COMPRESSOR

LEARNING OBJECTIVE

1. Terminal Learning Objective: Given an air compressor from an MK48, the required tools, shop supplies, repair parts, and TM 9-2320-297-34, per information contained in the reference, repair the air compressor. (5.1.2)
2. Enabling Learning Objectives: Given an air compressor from an MK48, the required tools, shop supplies, repair parts, and TM 9-2320-297-34, per information contained in the reference:
 - a. disassemble the air compressor, (5.1.2a)
 - b. inspect the disassembled components for serviceability, (5.1.2b)
 - c. repair or replace the unserviceable components, and (5.1.2c)
 - d. assemble the air compressor from serviceable components. (5.1.2d)

OUTLINE

1. **DESCRIPTION, NOMENCLATURE, AND FUNCTION OF THE AIR COMPRESSOR**

a. Design Characteristics

(1) The air compressor pressurizes air for operation of the air brake system and the auxiliary air system.

(2) The air compressor used in the MK48 is a two cylinder, single stage, reciprocating compressor with a rated displacement of 15.5 cubic feet of air per minute at 1,250 revolutions per minute. The compressor assembly is comprised of the following three cast iron subassemblies:

- (a) cylinder head,
- (b) cylinder block, and
- (c) crankcase.

(3) The cylinder head houses the discharge valves and is mounted to the cylinder block. The cylinder block houses the cylinder bores and inlet valves. It is mounted to the crankcase, which houses the crankshaft and main bearings.

(4) The compressor cylinder head and block are cooled by coolant circulating from the engine cooling system. Lubrication for the compressor internal parts is supplied by the engine pressurized oil system.

b. Operation. The compressor is driven by the vehicle engine and operates continuously while the engine is running. Actual compression of air is controlled by the compressor unloading mechanism and the governor. The governor maintains the brake system air pressure at preset maximum and minimum pressure levels.

(1) Intake and Compression of Air. During the down stroke of the piston, a slight vacuum is created between the top of the piston and the head. This causes the inlet valve to move up and off its seat. The discharge valve remains on its seat. The open inlet valve permits air to enter the cylinder through an air strainer. As the piston begins its upward stroke, the air in the cylinder is compressed. Air pressure on top of the inlet valve and the force of the inlet spring returns the inlet valve to its seat.

Compressed air then flows by the open discharge valve into the discharge lines, and goes on to the reservoirs. As the piston starts down, the discharge valve spring and the air pressure in the discharge line return the discharge valve to its seat. This prevents the compressed air in the discharge line from returning to the cylinder bore as the intake and compression cycles are repeated.

(2) Unloading Stage

(a) The air system governor is a spring poppet type unit that operates in conjunction with the compressor unloader piston assembly to maintain reservoir air pressure within the compressed air system operating range of 95 psi minimum and 120 psi maximum pressure.

(b) The unloader piston assembly is integral to the air compressor assembly. The unloader piston assembly controls the entry of inlet air from the air breather system to the compressor. A signal air line from the air governor actuates the assembly, and thus loads or unloads the

compressor as required to satisfy the changing requirements of the compressed air system.

(c) When air pressure in the reservoir reaches the cut-out setting of the governor, the governor allows air to pass from the reservoir, through the governor and into the cavity beneath the unloader pistons. This lifts the unloader pistons and plungers. The plungers move up and hold the inlet valves off their seats.

(d) With the inlet valves held off their seats by the unloader pistons and plungers, air is pumped back and forth between the two cylinders.

When air from the reservoir is used up and the pressure drops to the governor cut-in setting, the governor closes and releases the air from beneath the unloader pistons. The unloader saddle spring forces the saddle, pistons, and plungers down, and the inlet valves return to their seats. Compression is then resumed.

2. PROCEDURES REQUIRED TO REPAIR THE MK48 AIR COMPRESSOR

a. Instructions to Assistant Instructor

(1) (Make sure required tools, supplies, and reference materials are available for each student team.)

(2) (Prepare student work stations for practical application and performance test prior to commencement of exercises.)

(3) (Instruct students to notify an instructor if they need assistance or have a question.)

(4) (Control student activity to make sure students comply with guidance provided by the primary instructor.)

(5) (Critique student performance following completion of each evaluation exercise.)

(6) (Return completed grading sheets to the primary instructor at the conclusion of the performance test.)

b. Instructions to Students

(1) The remainder of this lesson will be devoted to a controlled practical application exercise and performance test which will give you the opportunity to practice and demonstrate your ability to perform the maintenance procedures that are accomplished by intermediate maintenance mechanics on the MK48 air compressor.

(2) The steps for performing each procedure are explained in TM 9-2320-297-34. You must have a student outline and the manual to perform the required procedures. If you do not have one, I need to know now.

(3) The TM will instruct you to discard particular items that are to be replaced with new ones during assembly of the compressor. However, here in the classroom, we will use the old components if possible. If you have any questions pertaining to replacing items on your compressor, ask an instructor.

(4) I will instruct you when to begin each procedure. When you receive these instructions, locate the procedures in your outline and the manual.

(5) Read the instructions and ask questions if you have any.

(6) All supplies that you will need are available at your work station.

(7) If you have any problems in performing the procedures, the instructor will provide assistance. However, the instructor will not perform the procedures for you.

(8) After you have completed each practice procedure, guided by the instructor, you will be given the opportunity to perform the same procedures on your own and your performance will be evaluated by the instructor assigned to your station as you accomplish each task.

(9) Do you have any questions?

c. Air Compressor Repair

(1) Disassembly of the Cylinder Head

(a) Remove the 10 capscrews from the cylinder head.

(b) Tap the cylinder head with a soft-faced hammer to break the seal of the cylinder head gasket.

(c) Remove the cylinder head and discard the cylinder head gasket.

(d) Remove and discard the two inlet valve springs, two inlet valves, and two inlet valve guides.

(e) Remove the plug from the cylinder block.

(f) Remove and discard the unloader spring, the unloader spring saddle, and the unloader spring seat.

(g) To aid in removing the unloader piston assemblies, apply a short blast of shop air to the port. Remove and discard the two unloader piston assemblies.

NOTE: Remove the inlet valve seats and the unloader bore bushings only if they are pitted, nicked, scratched, or damaged more than they can be dressed with fine emery cloth.

(h) Inspect the inlet valve seats and the unloader bore bushings. Use a mirror if needed.

(i) Remove the two inlet valve seats if they are damaged.

(j) Remove the two unloader bore bushings, if they are damaged, using an unloader bore bushing removal tool.

(k) Place the cylinder head on a bench, with the bottom side up.

(l) Measure the travel of the discharge valve by depressing the discharge valve until it bottoms against the discharge valve cap nut/stop. Then set the dial indicator so the indicator stylus contacts the discharge valve. Let the discharge valve up, and read the dial indicator. The travel should be between 0.030-0.046 of an inch. If the travel exceeds 0.046 of an inch, the discharge valve, discharge valve cap nut/stop, discharge valve spring and discharge valve seat must all be replaced.

(m) Secure the cylinder head in a soft-jawed vise, with the discharge valve seat up.

(n) Remove the two discharge valve seats, discharge valves, and the discharge valve springs. Discard the discharge valves and the discharge valve springs.

NOTE: The inlet spring seats and the inlet spring bores should not be removed.

(o) Turn the cylinder head over in the vise.

(p) Remove the two discharge valve cap nuts/stops.

(q) Remove the two capscrews, lockwashers, cover plate, and gasket. Discard the gasket.

(2) Disassembly of the Cylinder Block and Crankcase

(a) Secure the crankcase in a soft-jawed vise, with the cylinder block down.

(b) Remove the six screws and lockwashers. Discard the lockwashers.

(c) Remove the base plate and base plate gasket. Discard the gasket.

(d) Remove and discard the cotter pin.

(e) Remove the nut. It may be necessary to place a block of wood between the crankcase and the crankshaft as a jam.

NOTE: Matchmark the connecting rod caps with the connecting rods and remove one set at a time to avoid mixing mated parts.

(f) Remove the capscrews and remove the connecting rod cap with the bearing insert.

(g) Push the connecting rod with the piston assembly down and out of the cylinder block.

(h) Repeat the steps to remove the remaining piston.

(i) Turn the crankcase over in the vise and matchmark the crankcase with the cylinder block for proper location during reassembly.

(j) Remove the six capscrews with lockwashers and separate the cylinder block from the crankcase.

(k) Remove and discard the cylinder block gasket.

(l) Remove and discard the two bearing inserts and reassemble the connecting rod cap to the connecting rod, with the two capscrews.

(m) Remove the two wide piston rings and the three narrow piston rings from the piston.

(n) Remove the two teflon buttons and push the wrist pin out of the piston and connecting rod.

(o) Repeat the same steps for the other piston assembly.

(p) Remove the four capscrews with lockwashers and remove the rear end cover.

(q) Remove and discard the rear end cover gasket and the oil seal ring from the rear end cover.

(r) Remove the crankcase from the vise and place it in a press, with the mounting flange up.

NOTE: After the crankshaft is pressed out, the small ball bearing will remain in the crankcase.

(s) Press the crankshaft with the large ball bearing out of the crankcase.

(t) Remove the drive plate.

(u) Remove the key from the keyway of the crankshaft.

(v) Remove the three screws, bearing retainer, and the bearing from the crankcase.

(w) Remove the crankcase from the press.

(x) Turn the crankshaft over in the press, support the large ball bearing and press the crankshaft out of the ball bearing.

(3) Cleaning and Inspections Procedures

(a) Clean all parts in accordance with the technical manual.

(b) Inspect the cylinder head for cracks or damage. Apply shop air pressure to one of the coolant ports, with all the other ports plugged. Check for leakage by applying a soap solution to the exterior of the cylinder head body. If leakage is detected, replace the cylinder head.

(c) Inspect all ports for cracks, burrs, peened or crossed threads.

(d) Inspect all surfaces of the crankcase and the cylinder block for cracks or visible damage.

(e) Measure the outside diameter of the ball bearings and the inside diameter of their seats in the crankcase. The difference between the outside diameter and the inside diameter should be 0.0000 to 0.0015 of an

inch. This is to maintain proper fit. If the fit is too loose, the crankcase must be replaced.

(f) Inspect the ball bearings for nicks, pitting, scoring, or signs of wear.

(g) Inspect the cylinder block bores for scoring and out-of-roundness. Cylinder block bores that are scored or out-of-round by more than 0.001 of an inch must be rebored or honed oversize. Cylinder block bores must be smooth, straight, and round. Clearance between the pistons and the cylinder block bore walls should be between .002 of an inch minimum and .004 of an inch maximum. The pistons and piston rings are available in oversize increments of .010, .020 and .030 of an inch. Check the manual for the correct cylinder bore tolerances.

(h) Inspect the pistons for scores, cracks, or enlarged piston ring grooves. The clearance between the top of the piston ring and the top of the piston ring groove must be between 0.002 of an inch and 0.004 of an inch. Replace any piston failing inspection. Measure the outside diameter of the wrist pin and the inside diameter of the connecting rod bushing. The difference should not exceed 0.0007 of an inch. If the clearance exceeds the tolerance, the entire connecting rod assembly must be replaced.

(i) Check the fit of the wrist pins to the pistons. The wrist pins should have a snug fit in the pistons. Replace the piston and the wrist pin as an assembly if the fit is too loose.

(j) Inspect the crankshaft threads, keyway, ends, and all machined surfaces for wear, scores, or damage. Measure the crankshaft journals. If the crankshaft journals are out-of-round, excessively scored, or worn beyond what can be resurfaced per the tolerance chart in the manual, the crankshaft must be replaced.

(k) Inspect all parts for nicks, burrs, crossed or peened threads. Replace all parts failing inspection.

(4) Assembly of the Cylinder Block and Crankcase

(a) Support the crankshaft in the press and press the large ball bearing onto the crankshaft.

(b) Support the crankcase in the press, with the mounting flange down, and press the crankshaft and large bearing into the crankcase.

- (c) Secure the crankcase in a soft-jawed vise, with the mounting flange down.
- (d) Position the new rear end cover gasket on the crankcase.
- (e) Install the new oil seal ring on the rear end cover.
- (f) Compress the oil seal ring and install the rear end cover onto the crankcase.
- (g) Install the four capscrews and the new lockwashers to secure the rear end cover. Torque the capscrews to 175 to 225 inch-pounds.
- (h) Place the crankcase in the press and press the small bearing onto the crankshaft.
- (i) Place the crankcase over in the vise and secure it.
- (j) Secure the bearing retainer to the crankcase by installing and tightening the three screws.
- (k) Prick punch the screws and the bearing retainer so the three screws are locked in place.
- (l) Turn the crankcase in the vise so that the bottom end is down.
- (m) Place a new cylinder block gasket on the crankcase.
- (n) Align the matchmarks and position the cylinder block on the crankcase.
- (o) Install the six capscrews and new lockwashers. Torque the capscrews to 190 to 205 inch-pounds.

NOTE: To avoid mixing mated parts, assemble and install one piston assembly at a time. Prelubricate the wrist pins, pistons, piston rings, and bearing inserts.

- (p) Position the connecting rod in the piston then push the wrist pin into the piston and through the connecting rod.
- (q) Install the two teflon buttons over the wrist pin.
- (r) The correct piston ring gap, with the ring in the cylinder bore, is between 0.002 and 0.010 of an inch. Measure each ring gap.

(s) Install the piston rings onto the piston. The punch marked or beveled side of the piston rings must face the top of the piston. The gaps of the piston rings must be staggered.

(t) Turn the crankshaft so that one of the crankshaft journals is at the bottom of the crankcase.

(u) Remove the two capscrews and separate the connecting rod cap from the connecting rod.

(v) Coat the bearing inserts with clean oil and install them into the connecting rod and connecting rod cap.

(w) Apply a coat of oil to the cylinder bore.

(x) Compress the piston rings with a ring compressor.

(y) Insert the connecting rod and piston assembly into the cylinder bore. Push the piston down into the cylinder bore until the connecting rod and bearing insert are seated on the crankshaft journal.

(z) Position the connecting rod cap and bearing insert on the connecting rod.

(aa) Secure the connecting rod cap to the connecting rod. Use two new capscrews and torque the capscrews to 125 to 140 inch-pounds.

(bb) Turn the crankshaft one half turn (180 degrees) so that the other crankshaft journal is at the bottom of the crankcase. Use the same procedures and install the other piston and connecting rod assembly.

(cc) Secure the crankcase in a soft-jawed vise, with the bottom end up.

(dd) Install the key into the keyway of the crankshaft.

(ee) Install the drive plate onto the crankshaft, making sure the key aligns with the keyway in the drive plate and the crankshaft.

(ff) Place a block of wood between the crankcase and the crankshaft to act as a jam and install the nut on the crankshaft. Torque the nut to 114 to 126 foot-pounds.

(gg) Install a new cotter pin.

(hh) Position the new base plate gasket on the crankcase.

(ii) Position the base plate on the gasket and secure it with the six screws and new lockwashers. Torque the screws to 85 to 115 inch-pounds.

(5) Assembly of the Cylinder Head

(a) Secure the cylinder head, with the bottom end up, in a soft-jawed vise.

(b) Install a new gasket, the cover plate, two capscrews and new lockwashers onto the cylinder. Tighten the capscrews securely.

(c) Install the two discharge valve seats and torque them to 70 to 90 foot-pounds.

(d) Turn the cylinder head over in the vise.

(e) Install the two new discharge valves, two new discharge valve springs, and the discharge valve cap nuts/stops. Torque the discharge valve cap nuts/stops to 150 to 170 foot-pounds.

(f) Attach the fittings needed to connect shop air to the discharge port of the cylinder head and apply 100 psi. Apply a soap solution to the discharge valves and discharge valve seats. A slight leakage in the form of soap bubbles is permissible. If excessive leakage is found, leave the air pressure applied and with the use of a hardwood dowel and a hammer, tap the discharge valves off the discharge valve seats several times. This will help the discharge valves seat and should reduce the leakage.

(g) With the air pressure still applied, apply a soap solution to the area around the discharge valve cap nuts/stops. No leakage or bubbles are permitted. If leaks exist, check for cause and repair if possible. Replace the cylinder head or discharge valve cap nuts/stops as needed.

(h) Release the air pressure and disconnect the shop air from the cylinder head.

(i) Install two new unloader bore bushings at this time, if they were removed.

(j) The unloader bore bushings must be between 1.276 and 1.286 of an inch from the top of the cylinder block. If the measurement is less than 1.276 of an inch, grind down the unloader bore bushing. If the measurement is more than 1.286 of an inch, you will have to replace the unloader valve bushing.

- (k) Next, install two new inlet valve seats if they were removed.
- (l) Install the two new unloader piston assemblies.
- (m) Install a new unloader spring seat.
- (n) Install the new unloader spring saddle over the unloader piston assemblies.
- (o) Install the new unloader spring, making sure it seats on the unloader spring saddle and the unloader spring seat.
- (p) The inlet valve seats must be between 0.101 and 0.113 of an inch from the top of the cylinder block. If the measurement is less than 0.101 of an inch, grind down the inlet valve seat. If the measurement is more than 0.113 of an inch, you will have to replace the inlet valve seat.
- (q) Install two new inlet valve guides and two new inlet valves.
- (r) Install two new inlet valve springs into the cylinder head, by turning the inlet valve springs after they are in the cylinder head. Turning them should force the wire of the inlet valve springs into the spring seats, in the bottom of the spring bores. If this procedure repeatedly fails, use a very small amount of oil soluble grease to hold the inlet valve springs in place.
- (s) Position the new cylinder head gasket on the cylinder block and carefully aline the cylinder head with the inlet valve springs.
- (u) Secure the cylinder head to the cylinder block with ten capscrews. Torque the capscrews evenly to 15 to 20 foot-pounds.

REFERENCE

TM 9-2320-297-34